be taken to discover if any marked difference exists between the social composition of these groups. While this method may give satisfactory results at a moderate expense, it is far inferior in value to the method of repeated measurements at stated intervals. In this case the same subdivisions must be made, and changes in the social status and in the health of individuals must be recorded and eliminated. In order to carry out such a plan, it would be necessary to organize a bureau with sufficient clerical help to carry on the work. The questions underlying physical and mental growth are of fundamental importance for hygiene aud education, and we hope the time may not be far distant when a work of this character can be undertaken.

SOME ODDITIES IN BIRD-LIFE.

BY C. W. SWALLOW, WILLSBURGH, OREGON.

IT is not my intention, in this article, to describe any new species that are unknown to ornithologists, but there are many nature-lovers that cannot identify the birds easily; with such, I hope these descriptions may help and create a stronger desire to know more of the birds.

I will try to describe a few birds that are not as well known to the general observer as the robin, and which, by their rarity or peculiar habits, make them especially interesting to study.

The first species I will notice is Townsend's Solitaire (*Myadestes townsendii*). This is a rare bird to me, as I have never secured but one specimen. It may almost be called a hybrid between the thrushes and flycatchers, yet, by its color and flight, it somewhat resembles the shrikes. These birds are not as large as the robin, being a more slim bird with longer tail. They measure in inches somewhat as follows: Length, 8.5; extent of wings, 13.5; wing, 4.5; tail, 4.25; tarsus, .75. Their bill is about one-half inch long and strongly resembles the flycatchers, being broad and flat and slightly toothed. Bill and feet are black; the back is brownish ash, or slaty; the breast is lighter, shading into light ash on the crissum; top of head brownish black, lighter at base of bill; throat light ash; a light ring about the eye; wings and tail brownish-black; primary wing-feathers slightly edged with white and the secondary wing-feathers and outer tail-feathers quite extensively white-edged, the primaries and secondaries with a spot of yellow or tawny, giving the wing the appearance of having a bold bar of this color at the point of primary coverts; tail forked and slightly double-rounded.

This seems to be the only species of the genus found in the United States. They are probably more common between the Rocky and the Cascade ranges; but stragglers may be found west of the Cascades, even to the Pacific Coast; as I am informed by Mr. R. H. Lawrence that the species has been taken at Astoria. They are reported from New Mexico by A. W. Anthony in the *Auk*. Dr. Coues gives their range as north to British Columbia, stating that they build on or near the ground, laying bluish-white eggs, spotted with brown.

The Bushtits (*Psaltriparus*), although very small, dull-colored birds, are quite interesting and odd, as is also their nest, which is an ingeniously woven, pensile structure that may be found in bushes at the height of one's head, or twenty feet or more up in trees. One that I found last spring was near the end of a long hemlock limb, about twenty feet from the creek over which it hung. It was securely fastened to the small, slender twigs in three places. It was about nine inches long and four and one-half in diameter, outside. It was well and thickly woven, of moss and cottony substance, being strong enough to hold a number of pounds weight. The entrance was a small hole in one side near the top, and the bottom was well lined with feathers. They lay from six to nine small white eggs. These diminutive birds are only about four inches in length, with short, rounded wings less than two inches, and a narrow graduated tail somewhat longer than the wing. They are of a slate color above, shading into ashy on the under parts. They have no bright colors and are not crested. Bill and feet black. These lively little busybodies keep up a continuous twittering as they flit from twig to twig. There are but a few species found in the United States.

Psaltriparus minimus has a brown crown patch, while *P. plumbeus* has a lead-colored crown like the back.

P. lloydi has an ashy crown and black bars on sides of head. This is a southern bird, while the other two may be found as far north as Oregon or Washington.

A DEFINITION OF "SOLUTIONS."[1]

BY C. E. LINEBARGER, CHICAGO, ILL.

WITHIN recent years great progress has been made in our knowledge of solutions. This has been in main due to the application of the laws established for gases to solutions. Solutions are intermediate between liquids and gases. The theory of gases has been well developed, and the next problem is to devise a general theory of liquids. There are two ways of getting at the nature of liquids, — through the critical point and through solutions. Pellat[2] has recently shown the need of precision in the definition of the critical point, and has deduced from a consideration of the iso-thermal curves of carbon dioxide determined by Andrews[3] a definition at once concise and precise. It is my intention in this paper to subject to examination the existing definitions of solutions, and, if they be found inadequate or inaccurate, to propose another. Definitions, the preliminaries of science, are but landmarks of classification As scientific knowledge advances, the classifications and definitions change: they are provisional and progressive. Until within a few years, our notions of the nature of solutions were so vague that it was not possible to insist upon precise definitions; but now that we have a theory of solutions that rivals the theory of gases in simplicity and even surpasses it in the accuracy of its experimental results, it is time that a suitable definition be adopted.

Among the formal definitions of solutions (which are not very numerous) of acknowledged authorities, I will quote for the sake of comparison the following:—

(*a*) "Auflösung heisst, wenn sich ein fester Körper mit einer Flüssigkeit (einem tropfbar-flüssigen Körper) so verbindet, dass er in dieser Verbindung flüssig wird. . . . Die Flüssigkeit nennt man dann das *Lösungsmittel*, der vorher feste Körper heisst *aufgelöst*, und die neue Verbindung eine *Auflösung*" (Berzelius, Lehrbuch der Chemie, I., 424, fifth edition).

(*b*) "The liquefaction of a solid or gaseous body by contact with a liquid, the solid or gas being diffused uniformly through the liquid and not separating when left at rest" (Watts' Dictionary of Chemistry, article Solutions).

(*c*) "Lösungen sind homogene Gemenge, welche man durch mechanische Mittel nicht in ihre Bestandteile sondern kann" (Ostwald, Lehrbuch der allgemeinen Chemie, I., 606).

In these typical definitions there are three questions that require examination: (1) What is the state of aggregation of solutions? (2) Is homogeneity necessarily a characteristic of solutions alone? (3) What is to be understood by mechanical means, and is it true that solutions cannot be decomposed into their constituents by such means?

As to the first question, it is seen that the two first definitions regard a solution as liquid, which is, indeed, the common conception. Yet undoubtedly solids have the power of dissolving one another under certain conditions, so that a solution may be solid.[4] The expressions "solutions of gases in gases," of "liquids in gases," and even of "solids in gases" are quite general and used by good authorities. Thus the state of aggregation of solutions may be gaseous, liquid, or solid. (See, however, the definition proposed below).

But are there not homogeneous mixtures that are not solutions, no regard being had, however, to mixtures of powders, etc.? Every one knows what solutions of crystalloids, such as sugar or

[1] By solution is understood in this paper the ready-made mixture, no reference being had to its mode of formation; for the action of the solvent upon the substance to be dissolved as well as the product of the action is commonly called a "solution."

[2] De la Definition et de la Determination du Point Critique, Jour. de Phys. (3). I., 225.

[3] Phil. Trans. II. 1869.

[4] Van't Hoff. Zeitschrift für physikalische chemie, 5., 322.

salt, are like, and that is perhaps the reason that so little attention has been paid to the definition of solutions; what every one has a clear idea of, hardly needs defining. But when we come to speak of solutions of colloids, difficulties arise. It is not hard to distinguish true solutions of crystalloids, for they are characterized by the circumstance that for every temperature there is a fixed and constant ratio between the quantities of substance dissolved and solvent. But when we come to apply this criterion of solubility to colloid solutions, we find it insufficient. Some maintain that such solutions are in reality nothing but suspensions or emulsions[1]; and indeed this may be true in certain cases, for there exist as wide differences between colloids and colloids as between crystalloids and colloids. But the question at issue is, Can a suspension or emulsion remain perfectly homogenous for an indefinitely long time? The question can be answered in the affirmative in the case of suspensions or emulsions in which the suspended or emulsified particles have the same density as the suspending or emulsifying liquid. This is an extreme case, it is true. Still it proves that there may be entirely homogeneous mixtures which are certainly not solutions.

Again, it may be said that the surface tension between the extremely small emulsified or suspended particles and the liquid may be so great that, in comparison with it, gravity vanishes. According to this, even if there existed a difference of density between the particles and the liquid the emulsion or suspension would remain as such indefinitely. Their exist then homogeneous mixtures that may not be true solutions.

Further, under certain conditions, a true solution may become heterogeneous. If one part of a solution be at a different temperature or pressure from another, diffusion will take place and the solution will cease to be homogeneous.

With reference to the third question, probably all will agree in understanding by mechanical means, in this connection, filtration, subsidation, etc. In regard to subsidation, it has been shown above, that many emulsions and suspensions do not subside even after the lapse of a long time, so that this criterion fails in this respect. But let us see if we cannot separate a solution into its constituents by means of filtration. Take a solution of casein in dilute sodium carbonate, for instance. This passes quite freely through ordinary filter-paper; but if the paper be converted into parchment paper, although the sodium carbonate still passes quite freely through its pores, the casein is retained. If now an amorphous precipitate of ferrocyanide of copper be deposited in the parchment paper, even the salt is kept back, only the water being able to pass through the interstices of the precipitate. Thus by mechanical means a solution has been resolved into its component parts.

We conclude, then, that the existing definitions of solutions are inadequate; it remains to propose another more in accordance with fact.

Scientific definitions generally consist in the statement of certain attributes that separate as by a boundary the thing to be defined from all other things. If, then, there exists some attribute of solutions which is ever present, and indeed characterizes them as such; if other attributes are but different modes of expressing this essential attribute, such an attribute can well serve to define solutions. An attribute that fulfils the above conditions is the osmotic pressure. A solution is accordingly a *homogeneous mixture exerting an osmotic pressure.*

It is, of course, assumed that temperature and pressure are constant, else a solution might cease to be homogeneous. As osmotic pressure is a term applied only to mixtures in the liquid or solid state, it follows that "gaseous solutions" do not exist. For a "solution" of a gas in a gas, mixture is much the better term, and is indeed in common use; for a solution of a liquid in a gas, the proper word is still mixture, as well as for the rare case of the "solution" of a solid in a gas.

That osmotic pressure is the true criterion of solutions has strict scientific warrant. As soon as the conception of a pressure in solutions analogous to that in gases was gained, a great stride in advance was made. The most striking properties of solutions, diffusion, lowering of the freezing point, raising of the boiling point, are directly due to osmotic pressure; hence if osmotic pressure be predicated of solutions, it is implicitly stated that they diffuse, boil at a higher and freeze at a lower temperature than the solvent. All other properties of solutions are also more or less directly referable to osmotic pressure. The definition proposed is, therefore, entirely adequate, sharply separating solutions from all other mixtures.

[1] See my paper "On the Nature of Colloid Solutions" in American Journal of Science for March, 1892.

TEXAS GYPSUM FORMATION.

BY DUNCAN H. CUMMINS, AUSTIN, TEXAS.

PROMINENT among the strata composing the Permian formation in Texas, are the Gypsum Beds, which, taken with those of the north-west, are the most extensive of any such formations in the world. The Texas beds extend over an area of upwards of six million acres. Extending from the north line of the State, south, to the line of the Texas and Pacific Railroad, the beds vary in thickness from that of a sheet of paper up to seventy-five feet. The east line of the deposit passes Sweetwater, on the line of the Texas and Pacific Railroad, in Nolan County. The west line passes about twenty miles east of the Staked Plains. The greatest thickness of these beds is about nineteen hundred feet.

There are six forms of gypsum to be found in these beds, all contain the same chemical ingredients, but differ in their manner of crystallization: selenite, rose, massive, radiated, and fibrous gypsum, and alabaster.

The selenite is a clear, transparent variety, and may be split into very thin slices. Excellent cabinet specimens of this variety may be found in the red clays near Guthrie, in King County.

Rose gypsum is a foliated selenite, found only in one place in this belt, so far as has been reported, and that near Sweetwater, in Nolan County. The plates are fixed in the form of a rose and are so called by the people of that vicinity.

Massive gypsum is the principle form of which these beds are composed, this form occurs in beds of varying thickness at different horizons, ranging in thickness from one inch to seventy-five feet throughout this belt. It is generally white in color, but often it possesses a blue or reddish cast.

The radiated variety is usually round in figure, the lines of crystallization diverging from a common centre. This form possesses high specific gravity.

Fibrous gypsum, or satin spar as it is sometimes called, occurs in white or slightly colored deposits throughout this belt. Very few of these seams exceed two inches in thickness, although there may be seen in the museum of the Texas Geological Survey blocks of this form, from Kent County, exceeding twelve inches in thickness.

Alabaster occurs in many localities throughout the gypsum belt. Its beauty as a cabinet specimen is due to its color and translucent structure. It may be carved into many ornaments, and is capable of receiving a high polish.

Besides these six distinctive forms, the gypseous marls and the heavy beds of gypsiferous sandstones occur in great abundance throughout this area. Many of the above-mentioned forms have beautiful combinations and weatherings. Noticeable among these are a puddingstone gypsum, a combination of blue and white massive gypsum, a striated form composed of alternating layers of red and white massive gypsum, and a form of alabaster exhibiting very peculiar weatherings, grooves being washed in many directions on its surface, also a beautiful cabinet specimen from King County, it being round nodules of alabaster or selenite with a heavy incrustation of carbonate of copper.

On account of the scarcity of transportation, no uses are being made of these vast beds, which are unexcelled for use as fertilizers, or the manufacture of plaster of Paris.

In conclusion, to the scientist, Texas presents opportunities for study excelled by no place. Her geological and mineralogical products are subjects for discussion the world over, and no prettier field is open for investigation than the Texas gypsum formation.